CLAIMS

What is claimed is:

- 1. A material having an interconnected pore structure, comprising:
 - a viscous component; and
 - a plurality of biodegradable inclusions, wherein the inclusions comprise polymers.
- 2. The material of claim 1, wherein the viscous component comprises at least one material selected from the group consisting of PLGA, PLLA, PGA, and PCL.
- 3. The material of claim 1, wherein the polymers are cross-linked.
- 4. The material of claim 3, wherein the polymers are cross-linked by exposure to thermal, photo, or chemical agents.
- 5. The material of claim 1, wherein the inclusions have a shape comprising a three-dimensional star.
- 6. The material of claim 1, wherein the inclusions have a surface to volume ratio of greater than six times the unit edge of a bounding box.
- 7. A bone replacement material comprising:
 - a viscous component; and
 - a plurality of biodegradable inclusions, wherein the inclusions comprise polymers.
- 8. The bone replacement material of claim 7, wherein the viscous component comprises an aqueous-based composition or a polymer.
- 9. The bone replacement material of claim 8, wherein the aqueous-based composition comprises an aqueous lubricant and a calcium source.
- 10. The bone replacement material of claim 9, wherein the aqueous lubricant comprises at least one lubricant selected from the group consisting of saline solution, drug solution, PBS, and pure water.
- 11. The bone replacement material of claim 9, wherein the calcium source comprises at least one source selected from the group consisting of calcium phosphate, CaCo₃, CaOH, CaO, CaNO₃, CaCl₂, CaF₂, Ca alginates, and hydroxyappatite.
- The bone replacement material of claim 8, wherein the polymer comprises at least one 12. polymer selected from the group consisting of poly(l-lactic acid), poly(d l-lactic acid), poly(glycolic acid), poly(lactic-co-glycolic acid), poly(paradioxanone), poly(dl-glycolic acid), poly(propylene fumarate), oligo (PEG fumerate), poly(ethyleneglycol), poly(caprolactone), poly(hydroxybutyrate), poly(hydroxy valerate), poly(SA-HDA anhydride), poly(orthoesters), poly(phosphazenes), and copolymers of dl-lactic acid and dlglycolic acid.

13. The bone replacement material of claim 7, wherein the inclusions have an engineered shape.

- 14. The bone replacement material of claim 7, wherein the inclusions comprise at least one polymer selected from the group consisting of poly(paradioxanone), poly(dl-lactic acid), poly(dl-glycolic acid), poly(propylene fumarate), oligo (PEG fumerate) copolymers of dl-lactic acid and dl-glycolic acid, and mixtures thereof.
- 15. The bone replacement material of claim 7, wherein the polymers are cross-linked.
- 16. The bone replacement material of claim 15, wherein the polymers are cross-linked by exposure to thermal, photo, or chemical agents.
- 17. The bone replacement material of claim 7, wherein the viscous component comprises a polymer, and wherein at least one of the inclusions comprises the same polymer.
- 18. The bone replacement material of claim 7, wherein the inclusions comprise more than 30 vol. % of the bone replacement material.
- 19. The bone replacement material of claim 7, wherein the inclusions have a shape comprising a three-dimensional star.
- 20. The bone replacement material of claim 7, wherein the inclusions have a surface to volume ratio of greater than six times the unit edge length of a bounding box.
- 21. The bone replacement material of claim 7, wherein the inclusions have an aspect ratio greater than 1.
- 22. The bone replacement material of claim 7, wherein the inclusions are constructed by at least one technique selected from the group consisting of stereo-lithography, photo-lithography, stamping techniques, three-dimensional printing, extrusion, and fused deposition modeling.
- 23. The bone replacement material of claim 7, wherein all of the inclusions are in contact with at least one other inclusion.
- 24. The bone replacement material of claim 7, wherein the inclusions comprise a predetermined biodegradation rate.
- 25. The bone replacement material of claim 7, wherein the bone replacement material further comprises at least one therapeutic agent.
- 26. The bone replacement material of claim 7, wherein the bone replacement material has a compressive strength of at least about 20 Mpa.
- 27. The bone replacement material of claim 7, wherein the bone replacement material has between about 30 and 80 percent porosity.

28. A method for creating a bone replacement material, wherein the bone replacement material comprises a composite material, comprising:

- (A) providing a viscous component;
- (B) providing a plurality of biodegradable inclusions, wherein the inclusions comprise polymers; and
- (C) combining the viscous component and the plurality of inclusions to produce the bone replacement material.
- 29. The method of claim 28, wherein the viscous component comprises an aqueous-based composition or a polymer.
- 30. The method of claim 29, wherein the polymer comprises at least one polymer selected from the group consisting of poly(l-lactic acid), poly(d l-lactic acid), poly(glycolic acid), poly(lactic-co-glycolic acid), poly(paradioxanone), poly(dl-glycolic acid), poly(propylene fumarate), oligo (PEG fumerate), poly(ethyleneglycol), poly(caprolactone), poly(hydroxybutyrate), poly(hydroxy valerate), poly(SA-HDA anhydride), poly(orthoesters), poly(phosphazenes), and copolymers of dl-lactic acid and dl-glycolic acid.
- 31. The method of claim 28, wherein the inclusions comprise at least one polymer selected from the group consisting of poly(paradioxanone), poly(dl-lactic acid), poly(propylene fumarate), oligo (PEG fumerate), copolymers of dl-lactic acid and dl-glycolic acid, and mixtures thereof.
- 32. The method of claim 28, wherein step (B) further comprises constructing the inclusions.
- 33. The method of claim 32, wherein the inclusions are constructed by at least one technique selected from the group consisting of stereo-lithography, photo-lithography, stamping techniques, three-dimensional printing, extrusion, or fused deposition modeling.
- 34. The method of claim 28, further comprising:
 - (D) curing the bone replacement material.
- 35. The method of claim 34, further comprising
 - (E) removing the inclusions.
- 36. The method of claim 35, wherein the inclusions are removed by biodegradation.
- 37. The method of claim 34, wherein the bone replacement material has a compressive strength of at least about 20 MPa.
- 38. A method for replacing or reinforcing bone in vivo, comprising:
 - (A) providing a viscous component;

(B) providing a plurality of biodegradable inclusions, wherein the inclusions comprise polymers;

- (C) combining the viscous component and the plurality of inclusions to produce the composite material; and
 - (D) applying the composite material in vivo to replace or reinforce bone.
- 39. The method of claim 38, wherein the viscous component comprises an aqueous-based composition or a polymer.
- 40. The method of claim 39, wherein the polymer comprises at least one polymer selected from the group consisting of poly(l-lactic acid), poly(d l-lactic acid), poly(glycolic acid), poly(lactic-co-glycolic acid), poly(paradioxanone), poly(dl-glycolic acid), poly(propylene fumarate), oligo (PEG fumerate), poly(ethyleneglycol), poly(caprolactone), poly(hydroxybutyrate), poly(hydroxy valerate), poly(SA-HDA anhydride), poly(orthoesters), poly(phosphazenes), and copolymers of dl-lactic acid and dl-glycolic acid.
- 41. The method of claim 38, wherein the inclusions comprise at least one polymer selected from the group consisting of poly(paradioxanone), poly(dl-lactic acid), poly(propylene fumarate), oligo (PEG fumerate), copolymers of dl-lactic acid and dl-glycolic acid, and mixtures thereof.
- 42. The method of claim 38, wherein the bone replacement material is applied in vivo by injection.
- 43. The method of claim 42, wherein the bone replacement material is allowed to cure after injection.
- 44. The method of claim 38, wherein the bone replacement material is applied in vivo by a molding process.
- 45. The method of claim 38, wherein step (C) further comprises combining therapeutic agents with at least one of the inclusions or the viscous component.
- 46. The method of claim 38, wherein step (D) further comprises removing the inclusions from the bone replacement material.
- 47. The method of claim 46, wherein the inclusions are removed by biodegradation.
- 48. The method of claim 38, wherein the bone replacement material has between about 30 and 80 percent porosity.
- 49. The method of claim 38, wherein the bone is replaced in vertebroplasty and kyphoplasty applications.